SECTION C

Description/Specifications/Statement of Work

C.1 **SCOPE OF WORK**

The work the Contractor shall perform under this contract is described in the statement of work below:

INTEGRATED MISSION OPERATIONS CONTRACT II

STATEMENT OF WORK

Table of Contents

INTEGRATED MISSION OPERATIONS CONTRACT II (IMOC II)

INTRODUCTION

The Integrated Mission Operations Contract II (IMOC II) provides support and products for spaceflight operations capability development and execution for the Johnson Space Center (JSC) Mission Operations Directorate (MOD), the International Space Station Program (ISSP) including the Avionics and Software Office (OD), and the JSC Flight Crew Operations Directorate (FCOD). This includes support to mission preparation (Plan), crew, flight controller, instructor, and analyst training (Train), and real-time mission execution (Fly) activities related to exploration operations and the International Space Station operations. Operations capability development support is required from the contractor as NASA defines operations requirements associated with the emerging options for the exploration initiatives and potential new programs (including but not limited to the Multi-Purpose Crew Vehicle Program, the Space Launch Systems Program, the Lunar Precursor Robotic Program, the Human Research Program, the Exploration Technology Program, the Commercial Crew and Cargo Programs, and advanced technology and research).

The contractor will provide these support services for the Government who will lead, and be responsible for, the definition of processes and requirements, training and certification requirements, and mission execution direction including authorizing the course of action to resolve anomalies. The contractor will also provide support for Government-led mission preparation, training, and execution, and integration of those activities with spaceflight stakeholders including NASA Programs, other NASA organizations and Centers, and NASA Partners. Additionally, the contractor will provide support to Government-led new capability development, and other non-mission specific Programmatic support tasks.

The SOW is arranged with contractor management in section 1, technical support to MOD described in sections 2-5, technical support to FCOD in section 6, and technical support to the Avionics and Software Office in Section 7. The structure of the SOW should not be construed as defining a required organizational configuration.

100% of the work under the IMOC II contract will be negotiated through Task Orders (TOs). TOs can be either completion form (CF) or level of effort (LOE). Multiple TOs will be in effect during the performance period of the contract. The necessary management and administrative support required to supply the required technical support services will be negotiated via TO, based upon the total sum of technical services ordered. Although TOs can be issued or modified at any time, it is anticipated that the majority of services will be ordered on a yearly basis.

1.0 MANAGEMENT AND ADMINISTRATIVE REQUIREMENTS

Management and administrative tasks shall be performed by the contractor in order to develop and deliver the required support to MOD, ISSP Avionics and Software Office, and FCOD for spaceflight operations.

The contractor shall provide an innovative, efficient, and aggressively cost effective management approach implementing the appropriate structure, processes, and controls and understanding the unique IMOC II contractor / Government relationship to manage delivery of the key mission operations support services as ordered in the Management and Non-Technical Admin Support Task Order while meeting technical and performance requirements specified in the technical Task Orders.

1.1 MANAGEMENT

The contractor shall manage the IMOC II personnel to accomplish the contract requirements.

The contractor shall provide the business management control of the resources allocated to technical task order work content.

The contractor shall prepare all contract documentation in accordance with the Data Requirements Descriptions (DRDs). The deliverables of plans associated with the DRDs, once approved, will become part of the contract.

The contractor shall comply with all applicable statutes, regulations, NASA Directives, JSC Directives, and JSC internal documents (Attachment J-1 Applicable Documents).

The contractor shall obtain NASA approval prior to initiating or terminating any activity that requires a change to a NASA or other NASA contractor process. In the event that this change may impact this or other contract value, the approval shall also be obtained from the Contracting Officer.

1.1.1 CONTRACT MANAGEMENT

The contractor shall develop and implement management functions to ensure that all work activities are accomplished in accordance with contract provisions. The contractor shall provide and maintain management systems for the planning, organization, control, and reporting of all activities required by this contract. These systems will assure accomplishment of technical and schedule requirements and cost objectives. The contractor shall document these management functions and systems in accordance with DRD MGMT-01, Contract Management Plan. The contractor's management approach shall fully integrate all related plans and activities, including those of subcontractors and major vendors.

The contractor shall provide and maintain a Contract Work Breakdown Structure (WBS) in accordance with DRD MGMT-02, Contract Work Breakdown Structure and Dictionary. The contractor shall use the Contract WBS as the framework for contract planning, budgeting, cost reporting, and schedule status reporting to the Government.

The contractor shall provide reporting of financial and technical activities in accordance with DRD MGMT-03, Performance Reporting Plan. The contractor shall participate in contract management reviews with NASA management. NASA will determine the frequency and content of these reviews.

The contractor shall comply with the Government-managed process and provide their plan by which employees will complete certification training in accordance with DRD MGMT-04, Personnel Training and Certification Support Plan.

The contractor shall provide their overall staffing plan, including their recruiting and retention approach, to meet the demanding and specialized certification needs of the unique mission operations environment in accordance with DRD MGMT-05, Staffing, Recruitment, and Retention Plan.

The contractor shall develop and implement an Organizational Conflicts of Interest (OCI) Mitigation Plan in accordance with DRD MGMT-06, Organizational Conflicts of Interest (OCI) Mitigation Plan.

The contractor shall provide wage/salary and fringe benefit data in accordance with DRD MGMT-07, Wage/Salary and Fringe Benefit Data and DRD MGMT-08, Total Compensation Plan.

The contractor shall track and report on-site and off-site workforce, including subcontractors, when requested by NASA.

The contractor shall participate in Government-led benchmarking activities as directed and propose process efficiencies, innovative process changes, and potential cost reductions to NASA while maintaining technical capabilities. The contractor shall participate in reviews of proposed changes; however NASA will decide on implementation of any changes.

1.1.2 FINANCIAL MANAGEMENT

The contractor shall provide financial reporting by Task Order and include subcontractor financial data. The contractor shall provide financial and supplemental reporting in accordance with the DRD BP-01, Financial Management Report (NF533).

The contractor shall provide financial planning data to support the government budget process including but not limited to: Planning, Programming, Budgeting, and Execution [PPBE] budget calls, Operating plan budget calls, and special requests for budget impacts.

1.1.3 PROPERTY MANAGEMENT

The contractor shall provide, and implement, a Government Property Management Plan in accordance with DRD BP-02, Government Property Management Plan.

1.1.4 DATA MANAGEMENT AND INFORMATION TECHNOLOGY

The contractor shall maintain, operate, and secure data and software systems which provide for the management, collection, preparation, publication, control and dissemination of information and technical data required by this contract. The contractor shall not utilize proprietary or non-standard applications, protocols, or Information Technology (IT) systems without prior NASA contractual authorization.

The contractor process for the management of all data and documents generated under this contract shall be compliant with JPR 2314.2, Managing Internal JSC Documents and other associated document control directives identified in Attachment J-1 Applicable Documents.

The Government will provide the required IT workstations, systems, and equipment for the IMOC II on-site workforce as well as the associated IT management and security. The contractor shall develop and implement IT management and operational approaches for all corporate (non-government provided) IT associated with this contract, including workstations and systems for off-site personnel. The contractor shall develop and implement an IT capital planning and investment control process in accordance with DRD IT-01, Information Technology Capital Planning and Investment Control and an IT Security Plan in accordance with DRD IT-02, Information Technology Security Plan and Reports.

1.1.5 PROCUREMENT

The contractor shall procure supplies, services, and materials in support of MOD, FCOD, and ISSP (e.g. Avionics and Software) as authorized by Task Order to perform the contract requirements and to facilitate NASA's management oversight of IMOC II.

1.1.6 RISK MANAGEMENT

The contractor shall participate in Government risk management policies, processes, and standards, and shall manage risks appropriately. The contractor's risk management requirements shall include, but are not limited to:

a. Identifying, evaluating, managing, and controlling the safety, technical, cost, and schedule-related risks associated with all aspects of the performance of this contract.

b. Communicating identified risks to NASA management in a timely manner appropriate for the criticality of the risk.

c. For contractor proposed process changes, providing a risk assessment and corresponding issues to NASA management.

d. Providing risk mitigation as part of their assessment.

1.2 INSTITUTIONAL COMPLIANCES

1.2.1 SAFETY AND HEALTH

The contractor shall comply with JPR 1700.1, “JSC Safety and Health Handbook” for work done on-site at the JSC. The contractor shall develop and implement a Safety and Health Plan in accordance with DRD SMA-01, Safety and Health Plan and conduct a Safety and Health Program Self Evaluation in accordance with DRD SMA-02, Safety and Health Program Self Evaluation.

The contractor shall support compliance with the JSC Voluntary Protection Program (VPP) Star level certification through VPP audits and other activities.

The contractor shall serve as a Facility Manager (or alternate) for on-site JSC buildings occupied by MOD when required by the Government.

1.2.2 ENVIRONMENTAL

The contractor shall conduct all on-site work in compliance with JSC's Environmental Management System (EMS) in accordance with JPR 8550.1, Johnson Space Center Environmental Compliance Procedural Requirements. The contractor shall provide data on affirmative procurement, waste reduction activity, energy efficient product procurement, and ozone depleting substances in accordance with DRD-INST-01, Environmental and Energy Consuming Product Compliance Report.

1.2.3 QUALITY MANAGEMENT

The contractor shall perform all work on-site in accordance with the JSC Quality Management System. On-site quality assurance functions, responsibilities, and tasks will be specified, if required, per Task Order.

The contractor shall utilize the government-furnished discrepancy and anomaly reporting systems and databases for NASA systems.

1.2.4 SECURITY AND TECHNOLOGY PROTECTION MANAGEMENT

The contractor shall establish an effective and comprehensive technology protection program that encompasses control of classified information and material and sensitive but unclassified information, material, and services, including export controlled, and proprietary data/materials. The contractor shall develop and implement DRD-MGMT-12, Security and Technology Protection Management Plan.

The contractor shall comply with all appropriate sensitive information, export, and classified data control requirements and regulations.

The contractor shall provide export control compliance and services/functions for hardware, software, services, and data requiring export in the execution of specific contract responsibilities in accordance with the Department of Commerce (DOC) Export Administration Regulations (EAR), the Department of State (DOS) International Traffic in Arms Regulation (ITAR), the NASA Export Control Program (ECP), and the JSC Export Compliance Work Instruction (JWI 2190.1A). The contractor shall ensure that in the absence

of NASA exemptions or exceptions, that licenses and Technical Assistance Agreements (TAAs) are in place to support exports. The contractor shall provide the methodology and processes for the application of risk assessment to all security and technology protection activities and the integration of security and technology protection management across the contract and its subcontractors.

The contractor shall comply with NASA's Security Operating Manual (NISPOM) and classified information control executive orders and directives.

The contractor shall obtain National Security Facility Clearance Level (FCL per Clause I.11 Security Classification Requirements NFS 1852.204-75 (SEP 1989)) up to TOP SECRET/SENSITIVE COMPARTMENTED INFORMATION (SCI) and, as identified by the Government, provide SECRET/TOP SECRET security clearances for personnel supporting functions identified by NASA as requiring this level of clearance. NASA will sponsor SCI clearances.

1.2.5 RECORDS MANAGEMENT

The contractor shall maintain accurate originals, provide configuration management, and comply with the records control processes as required in the NPD 1440.6, NASA Records Management; NPR 1441.1, NASA Records Retention Schedules; and JPR 1440.3, JSC Records Management Procedural Requirements.

1.3 TECHNICAL ADMINISTRATIVE SUPPORT

The contractor shall provide general technical administrative and editorial services for the Government. These services shall include but are not limited to:

a. Providing the logistical function of documentation formatting, writing, editing, updating, reviewing, publishing, and distribution of mission operations documentation in hardcopy and in electronic media.

b. Providing graphics development, technical illustrations, and Computer-Aided Design (CAD) drawing support.

c. Providing technical assistance for the development and administration of web and SharePoint sites and developing templates, standard formats, macros, and subroutines to meet contract requirements.

d. Providing configuration management on associated products and processes, and configuration management of contract documents posted in various library systems and Web sites.

e. Coordinating required documentation for travel and security badging for official visitors

f. Data entry.

g. Scanning and file conversions.

h. Print shop interface.

i. Preparing Portable Document Format (PDF) versions for dissemination to electronic libraries.

j. Meeting support (e.g. administrative and logistical support, document preparation, configuration management, agenda preparation, technical minutes publication).

k. Maintaining MOD libraries and console documentation.

2.0 OPERATIONS SUPPORT FOR VEHICLE / SYSTEM/ PROGRAM DESIGN

This section addresses the operational support activities which occur prior to the start of mission preparation and execution (covered in sections 3 through 5).

Section 2 is largely more strategic than tactical in nature. Although the results of some of the work described in section 2 may evolve into what is used for actual mission planning, production, and execution, section 2 is primarily focused on making sure that vehicle, system, hardware, software, and ground systems design will be effective and operable.

More specifically, MOD's participation in the vehicle, system, and program strategic development phases primarily consist of two aspects:

a) Providing operational influence to the design and development of the vehicle and program architecture.

b) Providing direct support to the development activity through active participation in vehicle and program design and integration teams.

Participation in the development phases helps to ensure operational viability of the as-built systems and the knowledge gained supporting the development activity helps establish the base capability to support the mission preparation and execution phases.

2.1 OPERATIONS CAPABILITY DEVELOPMENT FOR VEHICLE / PROGRAM DESIGN

Prior to the start of mission preparation activities, NASA MOD provides an operational influence on vehicle and system design and program architecture and develops the initial plans and capability required to support the mission preparation and execution phases.

The contractor shall support the Government in providing operability assessments in support of systems and technology development for vehicles, cargo, flight equipment, and flight and ground systems. This includes but is not limited to:

a. Supporting design reviews and technical interchange meetings in order to convey the operations perspective to the design process.

b. Documenting MOD's recommendations to vehicle, cargo, flight equipment, and flight and ground systems design and requirement reviews.

c. Assisting in the Government-led development and evaluation of various mission or system designs, cockpit display options, command and telemetry options, trajectory profiles, consumables profiles, and flight techniques.

d. Providing support for program and project efforts of design engineering, software engineering, human rating, system architecture, integrated test planning, system requirements, configuration control, and risk management activities.

e. Supporting development of operational methodologies (e.g. Day of Launch trajectory updates) to meet vehicle or system design requirements/constraints, improve capability (e.g. launch probability), or optimize the design.

f. Providing support to Government-led analysis, operational scenario development, trade studies, and lessons learned.

The contractor shall support the Government-led development of mission requirements, operational implementation concepts, products and plans. These inputs support determination of vehicle, system, and program and operations architecture requirements. Support shall include but is not limited to:

a. Supporting the development of operations concepts, mission timelines, and associated documentation.

b. Supporting the development and execution of analog missions in order to create operational concepts.

c. Evaluating the requirements, system / vehicle designs, and plans to determine alignment with the concept of operations baseline; identifying and proposing solutions for any areas of inconsistency impacting operations.

d. Developing concepts for analysis, design, and operations support tools.

e. Developing reports, assessments, and technical evaluations that assess, verify, and validate program-level requirements and requirement changes that have potential impact to procedures, safety, operations, or mission success.

f. Performing trade studies, analysis, reference trajectory design and risk assessments.

g. Supporting failure scenario identification for each Program, vehicle, or system and developing the operations response to those failures based on the vehicle's or system's capabilities (hardware redundancy and software capabilities).

h. Supporting preliminary assessments of processes, and roles and responsibilities required for eventual mission preparation and execution.

The contractor shall support system verification and validation activities which include but are not limited to:

a. Reviewing and providing an operational assessment of hardware and software test plans and verification and validation objectives.

b. Participating in vehicle tests including but not limited to: hardware, software, vehicle stand alone, vehicle integrated, and end-to-end with the Mission Control Center (MCC), International or other Partner, and other control centers as applicable.

2.2 OPERATIONS DESIGN AND DEVELOPMENT – PROGRAM DIRECT

NASA MOD's direct participation as core members of vehicle, system, or program design and integration teams assists NASA MOD in gaining system and vehicle knowledge thus enabling an efficient transition to the mission preparation and execution phases. Direct participation also affords additional opportunities outside of the normal Program review cycles to influence design decisions impacting operability.
The contractor shall participate in vehicle or system design, development, and testing activities in which NASA MOD is directly supporting other NASA and/or external organizations.

Contractor support to tasks directly supporting vehicle or system design and development shall include but are not limited to:

a. Participation in Program and Engineering design and integration teams.

b. Participation in flight and ground software development and implementation including verification and validation tasks.

c. Participation in hardware and/or software test development, integration, and execution; including development of test procedures, execution of tests, and writing post-test reports.

2.3 PROGRAM TO PROGRAM INTEGRATION

Mission Operations inherently involves integration between Program elements and vehicle / systems so it is practical and desirable for NASA MOD to participate in critical integration activities during the development phases of a Program, vehicle, or system design activity. NASA MOD provides integration experience in support of the development phases and the participation serves as an effective bridge to support integration activities during the Mission Operations preparation (Plan) process.

The contractor shall support the Government in providing integration support between program elements and between external entities. The support includes development of technical assessments, providing analysis of interface requirements and issue resolutions, providing coordination, and facilitating information exchanges. The integration tasks shall include but are not limited to:

a. Design of abort methodologies for spacecraft, launch vehicles, and orbiting elements.

b. Public safety risk assessments for spacecraft, launch vehicles, and orbiting elements.

c. Timeline, trajectory, and attitude plan development based on multi-spacecraft requirements and constraints.

d. Coordination and utilization of other government agency assets to ensure crew safety and mission success. Includes planning and scheduling DOD, FAA, State department and foreign and military agencies to assist in launch/landing area coordination, search and rescue services, orbital debris tracking, and airspace clearance.

e. Integration and coordination of the communications, tracking, and navigation Program requirements and interfaces with the available tracking and communication networks and organizations (e.g. Spacecraft Communication and Navigation, NASA Integrated Services Network).

f. Support activities involving multiple program elements addressing topics including but not limited to end-to-end reference mission design and assessment of integrated vehicle and mission performance.

3.0 MISSION OPERATIONS PREPARATION (PLAN)

Sections 3 through 5 generally address the tactical phase of operations. The requirements described focus on the work required to plan, train, and execute (fly) spacecraft and crew mission operations.

The Mission Operations preparation process involves the development of plans, products, and analysis required for mission execution. Mission preparation begins with establishing mission objectives and priorities and continues through preflight preparations to develop integrated, executable plans for the crew, vehicle, systems, and ground team members and the supporting operational procedures and products needed to accomplish those objectives. It includes all aspects of mission timeline development, cargo and payload integration, flight rules development, crew and ground procedure development, command and telemetry definitions, flight techniques development, launch commit criteria development, and utilizing post-flight reports, debriefs, and anomaly resolution plus safety and hazard reports during the preparation phase.

Mission plans and procedures are constrained by and conform to the launch commit criteria, operational flight rules, vehicle hardware and software configuration, operational ground rules and constraints, mission priorities and objectives, and engineering specifications that define acceptable flight envelopes, flight safety, human rating requirements, and other NASA and programmatic policies and regulations.

3.1 TECHNICAL INTEGRATION AND PROCESS SUPPORT

Technical integration with multiple organizations and across many forums is required in order to acquire, coordinate, and document operational and technical information needed to build the mission plans, products, and processes necessary to execute a safe and successful mission. These organizations include but are not limited to all MOD organizations, associated Program and Project elements, other NASA centers, other agencies, International and commercial partners, and other external organizations.

3.1.1 PROGRAM / PROJECT LEVEL INTEGRATION SUPPORT

Contractor support to NASA Program-led mission preparation involves studying the operational feasibility of Program level mission requirements and priorities, in the context of mission objectives. It entails support to programs and projects in the strategic and tactical planning timeframes.

The contractor shall provide program/project level integration support including but not limited to:

a. Providing technical inputs to the MOD representatives to the programmatic boards, associated sub-boards, and panels.

b. Presenting the MOD position.

c. Developing and delivering presentations and formal documentation.

d. Identifying impacts due to proposed requirements or schedule changes.

e. Exchanging technical vehicle, systems, and operations information.

f. Interfacing with Program/Project element organizations to resolve flight preparation process implementation issues.

g. Participating in Government-led trade studies, assessment activities, and action item resolution as necessary, to support mission preparation.

h. Participating in the coordination and technical review of Program Level Change Requests (CRs).

3.1.2 PARTNER COORDINATION AND SUPPORT

The contractor shall provide an integration role for coordination with all NASA partners (e.g. International Partners, commercial cargo and crew partners, and other partners). These integration tasks shall include but are not limited to:

a. Planning and executing the mission's tasks relative to the partners.

b. Producing integrated flight and training products.

c. Defining telemetry and commands available to crew, Mission Control Center-Houston (MCC-H), and partner MCCs including inputs to products and processes for implementing the telemetry and commands.

d. Integrating, developing, and implementing multi-segment/vehicle procedures.

e. Providing inputs into mission preparatory activities at the partner's facilities, including but not limited to prelaunch testing, operations integration, training, and other activities preparatory to the launch of the partner's hardware or software.

f. Integrating partner's flight controller operations with MOD flight control elements.

When directed by the Government, the contractor shall provide flight control team functions at the MCCs of the partners to accomplish vehicle and flight systems operations to ensure safety and mission success.

3.1.3 TECHNICAL INTEGRATION AND PRODUCTION PROCESS

The contractor shall support the Government in integrating the processes and schedules required to efficiently deliver flight products. This shall include but is not limited to:

a. Flight production schedule integration.

b. Ensuring consistency in product content on a flight specific basis across the entire process and resolving issues associated with product content.

c. Providing technical integration required to develop, coordinate, and implement mitigation plans for flight production process issues.

d. Tracking of flight software and data reconfiguration changes and the consistent incorporation of these changes into mission operations processes and products.

e. Conducting integrated assessments of proposed manifest changes including multi-flight impacts.

f. Integrating change request evaluations and responses that impact the flight production process.

g. Representing the production process and its entities at Directorate, Program, and Project panels.

The contractor shall support the Government in integrating test requirements and support coordination of the required testing of flight software product deliveries associated with the flight production process.

3.1.4 MISSION SAFETY INTEGRATION AND ANALYSIS

The contractor shall provide support to the Government for assessments and recommendations on spacecraft, systems, and payload safety requirements and compliance including but not limited to:

a. Providing safety issue resolution, real-time safety analysis, and safety knowledge for various pre-flight planning meetings (e.g., Joint Operations Panels, Flight Operations Panels, and Safety Review Panels).

b. Providing support to Government safety assessments and recommendations on design and requirements; procedures and flight rules; integrated hazard analyses (including facilitating and technical input to operational controls agreements (such as Operational Controls Agreements Database (OCAD)); integrated safety verification reports (e.g., Independent Safety Verification Review (ISVR)); safety data packages; test assessments; reports; and development test reviews.

c. Participating in working groups, reviews, control boards, and panels to support the Government in providing technical operational inputs into safety analysis and integration.

d. Presenting the NASA MOD position in safety forums such as the Safety Engineering Review Panel (SERP) or equivalent, S&MA Safety Boards, and Payload Safety Review Panel.

e. Providing technical inputs for the maintenance of MOD Safety Reliability & Quality Assurance (SR&QA) Plan (JSC 36528, Vol 1 & 2).

f. Providing support in the assessment for compliance with MOD SR&QA Plan.

g. Assisting the Government in preparing Hazard Analyses per JPR 1700.1 JSC Safety and Health Handbook for IMOC II activities to comply with facility system safety requirements to identify critical items for mitigation or elimination (e.g., Space Vehicle Mockup Facility user testing).

3.1.5 MISSION READINESS

The contractor shall support the Government-led Certification of Flight Readiness (CoFR) process by providing input to and review of CoFR documentation for government-managed mission preparations in accordance with the MOD CoFR Implementation Plans. The level of support, as directed by NASA, shall include but is not limited to:

a. Review of organization endorsement statements defined by the associated Program(s) and MOD.

b. Providing a status of the activities, tasks, products, and facilities covered by the endorsement statements.

c. Development and review of CoFR presentation charts, statements, and sign off documentation.

d. Presentation and/or support at CoFR, FRR, and other preparation meetings.

3.1.6 MISSION PREPARATION TECHNICAL ADMINISTRATIVE SUPPORT

The contractor shall provide administrative support to mission preparation technical tasks and processes including but not limited to:

a. Scheduling console support and other activities.

b. Documentation management (e.g. editing, coordination of translation, and change coordination, documentation, and publication).

c. Change request distribution and response tracking; submittal of MOD's responses.

d. Records and database maintenance including report generation.

e. Meeting support.

3.1.7 MISSION OPERATIONS PROCESSES DEVELOPMENT SUPPORT

The contractor shall provide support to Government-led development and assessment of MOD's mission preparation and execution processes including but not limited to:

a. Participating in the development of efficient and integrated flight production processes, including definition of product exchanges and format.

b. Participating in the development of processes for the production, maintenance, and distribution of operations documentation.

c. Identifying improvements to flight techniques, products, and policies.

d. Participating in Government-led trade studies and benchmarking as directed by NASA to continuously seek improved processes and operational concepts.

e. Performing research into past Space Programs' history to determine applicability of existing processes and products as candidates for reuse and documenting these findings with rationale as input to the Government-led effort to capture lessons learned.

3.1.8 SPECIAL DEVELOPMENT PROJECTS

The contractor shall support special Plan-Train-Fly projects as requested by the Government. The format and process for reporting on these projects will be specified by the Government.
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3.2 OPERATIONS PRODUCTS DEVELOPMENT AND SUPPORT

Operations products are the standard plans, procedures, analysis and data generated as part of the mission preparation process that are required to operate a mission. Operations products include the following categories:

- Mission Execution Products: Plans, procedures, constraints and other documentation required for mission execution to ensure all mission objectives are performed safely and successfully.

- Mission Design Products: Standard mission analysis and data generation that feeds into the development of mission execution products.

- Flight Software (FSW) Command and Telemetry Reconfiguration Products: Flight software reconfiguration products and assessments of impacts of changes to FSW.

- Crew and Other Support Products: Products for crew psychological support and supplemental video services for crew and operations personnel to support training and operations.

3.2.1 MISSION EXECUTION PRODUCTS

The contractor shall develop and maintain products required for mission execution.

The contractor shall ensure all mission objectives, requirements, and constraints are properly integrated and implemented in the mission execution products.

Mission execution products and associated activities shall include but are not limited to the following:

a. Develop integrated and executable activity, attitude, trajectory, consumable, resource, robotic, and communication plans and schedules.

b. Develop and validate mission procedures for crew or ground-based execution, which are consistent with mission objectives, vehicle and system configuration, ground systems capabilities, and vehicle and mission constraints.

c. Develop, verify, validate, and certify automated scripted flight software procedures that run a series of commands for a given set of conditions or events.

d. Develop ground support products (e.g., console procedures, console handbooks, Operational Interface Procedures (OIPs), systems briefs, schematics, and console tools).

e. Develop flight rules, launch commit criteria, and other operational constraints documentation.

f. Provide operational inputs (including but not limited to briefing preparation, presentation, and action item response), and technical representation to boards, panels, and working groups (e.g., Operations Readiness Reviews (ORRs), Joint Operations Panels (JOPs), Flight Operations Panels (FOPs), Operations Working Groups (OWGs), Technical Interchange Meetings (TIMs), Flight Operations Reviews (FORs), Procedures Control Boards, Mission Management Team meetings (MMTs), Weekly Plan Reviews (WPRs)).

g. Coordinate and integrate with all stakeholders in the development of products (e.g. discipline mission lead coordination tasks).

h. Support the Government in the resolution of operational issues and incorporation into mission products.

i. Review and provide input to launch or return hardware manifests.

j. Review hazard reports, provide inputs to the development of operational controls, and incorporate these controls into operational products.

k. Conduct procedure verification and validation testing.

l. Utilize lessons learned from past operations in the development of the mission products.

m. Integrate crew, spacecraft, system, cargo and payload requirements, objectives, and constraints into the executable mission products and plans.

n. Develop and integrate inventory and stowage management plans and procedures.

o. Provide engineering and operations inputs to ensure all vehicle system issues are properly addressed and integrated into the executable mission products.

The contractor shall, using NASA-identified software products, support the Government in the generation, testing, and certification of support products including but not limited to:

a. Instructor, analyst, and flight controller displays used in training and mission facilities.

b. Vehicle system/sub-system functional and resource models.

c. MOD process flow diagrams.

d. Electronic procedures.

e. Automation scripts.

f. Crew psychological support products such as music, picture, commercial off the shelf (COTS) software, and video lab software for crew use onboard.

The contractor shall ensure MOD operations products follow NASA MOD product standards and guidelines including but not limited to:

a. Procedure standards reference.
b. Operations nomenclature.
c. Other guidance documents.

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The contractor shall ensure that the operations products are published, configuration managed, and distributed to a specified schedule based on program or mission milestones in order to effectively support the training and mission schedules. This shall include but is not limited to:

a. Crew procedures and products (including electronic and hardcopy).
b. Flight controller ground procedures.
c. Operations interface procedures.
d. Flight Rules and other mission constraints documentation.
e. Mission preparation procedures.
f. Discipline-specific user guides, and technical operations support documentation (e.g., systems manuals, data books, software handbooks, drawings, schematics).

The contractor shall generate and maintain spaceflight hardcopy products including but not limited to:

a. Fabricating cue cards, hardcopy books, cuff checklists.
b. Providing office-type supplies needed on-board the spacecraft (e.g. pens, paper, markers).
c. Maintaining certified materials used in fabrication of hardcopy products.
d. Maintaining bonded storage area for hardcopy products.
e. Assisting the Government in maintaining non-office automation related equipment in support of spaceflight hardcopy products fabrication.

3.2.2 MISSION DESIGN PRODUCTS

The contractor shall develop mission design products such as trajectory, attitude, communications, consumable, and robotic profiles and plans that meet mission requirements including but not limited to:

a. Ascent and Entry trajectory design, including but not limited to abort boundary determination and entry profiles.
b. Rendezvous and proximity operations design, including but not limited to abort/breakout design and rendezvous profiles.
c. Performing mission design related to spacecraft resources, thermal, consumables, attitude, trajectory, robotic, communication, structural, electrical power, and other analyses.
d. Analyzing robotics maneuvers.

3.2.3 FLIGHT SOFTWARE, COMMAND, AND TELEMETRY DATA PRODUCTS

The contractor shall select command and telemetry data as inputs to the reconfiguration process to meet mission objectives and to monitor and control vehicle operations.

The contractor shall participate in the Government operational assessment of vehicle and system flight software (FSW) requirements/discrepancies and integration of flight software technical issues, operational impacts, and ground system impacts resulting from new requirements and discrepancies into operations products.

This participation shall include but is not limited to:

a. Analysis and resolution of FSW change requests.
b. Support FSW related meetings, boards, panels and working groups.
c. Preparation for future FSW uplinks.
d. Support of testing for each new FSW release.
e. Definition of Caution and Warning (C&W) terms, and their state (enabled or suppressed).

3.2.4 CREW AND OTHER SUPPORT PRODUCTS

The contractor shall develop, implement, and support operation of hardware and software data products to meet crew support systems requirements. Requirements are provided by the Government.

Tasks associated with the crew support systems products shall include but are not limited to:

a. Developing crew personal webpage or equivalent media in support of on-orbit psychological support.
b. Building the crew support computer network or equivalent media.
c. Integrating Computer Based Training (CBTs), On-Board Training (OBT), Just-In-Time Training (JITT), and simulators used on the space vehicle.
d. Providing support to the on-board crew support computers.

The contractor shall provide video recording and editing services in support of MOD Crew, Flight Controller, Instructor, and Analyst training and Flight Crew operations including but not limited to:

a. Recording of training sessions/events.
b. Editing of recordings and converting to DVD or equivalent media.
c. Producing computer based training video content.

The contractor shall support the Government in the maintenance and troubleshooting of the software and hardware for crew support functions.

As directed by the Government, the contractor shall follow NASA defined storage procedures for spaceflight related equipment and products.

3.3 MISSION OPERATIONS ANALYSIS

Mission operations analysis is the unique analysis performed to analyze new requirements, operational techniques, or anomalies.

The contractor shall produce analyses, technical assessments, and anomaly resolution recommendations including but not limited to:

a. Developing and evaluating trajectory profiles.

b. Providing analysis of ascent targeting, aborts, orbit insertion, phasing and other orbit adjust burns, rendezvous and proximity operations trajectory, deorbit burns, entry targeting, re-entry and/or disposal trajectory, multi-vehicle separation and re-contact scenarios, material jettison scenarios, vehicle attitude design, communications coverage, and landing site determination and dispersions.

c. Providing ascent and entry range safety analysis.

d. Performing vehicle, system, cargo, and payload assessments.

e. Collaborating with the Government on defining and developing Development Test Objective (DTO) requirements.

f. Assessing potential failure cases to determine workaround plans in advance.

g. Assessing vehicle or system capabilities to assist the Government in the development of new procedures or operational concepts.

h. Analyzing the impact of vehicle or system software and hardware configuration changes.

i. Utilizing information from post mission reports, analyses, debriefs, and anomaly reports and resolution as the basis for updates to vehicle and system hardware and software, mission and training products, and operational capabilities.

j. Providing support to Government forums in order to identify, track, and coordinate implementation/incorporation of analysis impacting mission preparation and execution.

3.4 SUPPORT TO MISSION SYSTEMS AND TRAINING SYSTEMS DEVELOPMENT

Mission systems include all facilities and systems used for mission preparation and execution such as the Mission Control Center (MCC) as well as user applications and tools used in PTF operations. Training systems includes all training facilities and systems such as the Space Station Training Facility (SSTF), part- and full-task simulators (including international partner simulators), Space Vehicle Mockup Facility (SVMF), and Neutral Buoyancy Laboratory (NBL).

The Government determines and manages all mission and training systems and user application tool requirements and with contractor assistance verifies compatibility between user applications and mission and training operating platforms.

3.4.1 MISSION AND TRAINING SYSTEMS SUPPORT

The contractor shall support the Government in providing requirements analysis, test, and certification support to MOD's development of mission and training systems for mission control, planning, training, and data management including but not limited to:

a. Government-led strategic planning based on MOD Needs, Goals, and Objectives.

b. Operations concepts and scenarios.

c. Participation in process flows based on requirements changes.

d. Participation in design reviews including development and assessment of requirements.

e. Analysis of requirements, review of design, verification of functionality, and test readiness/testing support for mockups, simulators, hardware, and software.

f. Authoring acceptance testing procedures and plans.

g. Support to testing / training readiness reviews, software acceptance reviews, and operational readiness reviews.

h. Participation in testing of these systems.

i. Participation in mission and training systems meetings, boards, panels, and working groups.

The contractor shall participate in activities for sustaining mission and training systems, mockups, simulators, hardware, and software including but not limited to documenting discrepancies, prioritizing sustaining work, and testing resolution of discrepancies.

3.4.2 USER APPLICATION REQUIREMENTS, VALIDATION, AND TESTING SUPPORT

The contractor shall provide support to the Government's development of requirements and user testing and validation for user applications and tools that are used in PTF operations. The process for the development of requirements is defined in the Mission Operations Directorate Software Management Plan (JSC 63756).

Per Government direction, the contractor shall provide support to NASA MOD development of PTF user applications and tools including the following:

a. Prototyping tools and user applications for proof of concept to drive out user requirements.

b. Generating a subset of office automation software/web type tools (e.g. Office macros, Sharepoint workflows)

4.0 MISSION OPERATIONS TRAINING (TRAIN)

Mission Operations training encompasses the tasks, methods, products, and media utilized to fully prepare the crew, flight controller, instructor, and analyst personnel involved in the operational design and execution of spaceflight missions. This includes but is not limited to instructional techniques and capabilities to prepare the spaceflight crew to perform all required tasks between launch and landing; the flight control team members to perform all required tasks to plan and execute spaceflight operations; analysts to develop mission support data products; and instructors to develop and conduct training.

Certified instructors are utilized to conduct all training of flight crews and MOD personnel in positions requiring certification as well as any other students as directed by NASA. Certified Instructors may serve in a single standalone instructor role or on a training team composed of both NASA and contractor discipline-specific personnel who are functionally organized to work together seamlessly to ensure the crew members and Flight Controllers operate their systems safely and achieve mission success.

Mission Operations training covers the nominal operation of spacecraft and ground systems; the identification of and response to operational anomalies and malfunctions; execution of the planned timeline (including but not limited to cargo, payloads, Detailed Test Objectives (DTOs), stowage packing and unpacking, commanding, systems operations, and transfer operations); and “soft skills” required to be an effective member of a team (e.g., decision-making, leadership, communication, teamwork, situational awareness, and mission cognizance). As needed, mission specific training for International Partner (IP) or other Partner astronauts also focuses on teaching with an interpreter throughout all phases of their training and in all training media.

4.1 TRAINING DEVELOPMENT

4.1.1 TRAINING REQUIREMENTS DEVELOPMENT

The contractor shall support the Government-led development of training requirements, including but not limited to:

a. Conducting training needs analyses from which Government-directed training products and training flows are developed, including the training content to be supported in personal studies, stand-alone lessons, integrated simulations, joint simulations with International Partners and other partners or external customers as appropriate, and the proper points for evaluations throughout the training process.

b. Providing technical input to training requirements definition.

c. Documenting mission operation tasks that require training.

d. Documenting and distributing training requirements.

e. Coordinating with NASA MOD and external organizations (e.g., program office, crew office, IPs, other partners, and other operations personnel) to document the crew tasks requiring training.

f. Coordinating IP and other Partner crew training requirements inputs. Providing technical input to the development of guidelines, operations concepts, and requirements for multi-segment and joint multi-segment simulation training.

g. Documenting training plans and training flows for assigned crews.

h. Documenting Certification Plans and training flows for MOD flight controller, instructor, and analyst personnel.

i. Developing familiarity with IP and other partner training facilities, curricula, and courseware.

j. Assessing IP and other partner training requirements and plans.

4.1.2 TRAINING PRODUCTS DEVELOPMENT

In accordance with the Government-led MOD training development standards and processes and based on generic and mission or increment specific-requirements, the contractor shall support the Government in the development, production, and maintenance of lessons and training materials, including but not limited to schematics, drawings, presentations, and handouts. Training will be conducted in appropriate media to facilitate learning, including but not limited to:

a. Classroom
b. Part-Task Trainer
c. Full-Task Trainer
d. Mockups
e. Test Facilities
f. Onboard Training (OBT)
g. Just-In-Time Training (JITT)
h. Electronic Media
i. Computer-Based Training Media
j. Distance Learning Media
k. On-The-Job Training (OJT) Console Training

The contractor shall support the Government in the planning and production of generic and mission or increment specific simulation input products, including but not limited to:

a. Developing simulation timelines.
b. Developing simulation scripts.
c. Creating simulator data-stores.
d. Providing inputs for instructor tools and displays.
e. Creating other simulation unique training products.
f. Simulation unique procedures.

The contractor shall support the Government in the design and development of training curricula and lessons that meet MOD Space Flight Personnel Certification Plan (DA-WI-16) and Flight Controller, Instructor, and Analyst certification requirements per NASA-defined discipline specific certification plans.

The contractor shall support the Government in all facets of crew training preparation, lesson development, and execution for Astronaut Candidates (ASCANs), U.S., International Partner (IP) and other Partner crewmembers, and space flight participants to meet their specific crew training plans.

The contractor shall support the Government in coordinating training product development and content with other NASA centers, and with International and other Partners to optimize content and training time.

4.2 TRAINING PLANNING, INTEGRATION, AND SCHEDULING

The contractor shall provide support to the Government for all phases of the planning, scheduling, integration, and tracking of Astronaut Candidate (ASCAN) and crew training, MOD flight controller, instructor, and analyst training, proficiency training for all students, and training for other personnel as requested by NASA.

For assigned Crew training, this integration process starts several years before each mission begins in order to coordinate the crew and mission's training requirements and activities with all NASA organizations and Partners.

The contractor shall implement and maintain products in support of Government-led planning for training and scheduling.

4.2.1 TRAINING PLANNING

The contractor shall provide Training Planning support including but not limited to:

a. Assisting the Government in developing, documenting, and maintaining integrated processes and databases used to manage training, including but not limited to crew training budget process, crew feedback, student evaluation process and database, flight controller performance criteria, instructor performance criteria, other feedback processes and databases.

b. Providing input to support MOD's development, documentation, and maintenance of the Government-led, MOD training standards and processes utilized in the production of all flight specific and generic training products.

c. Supporting the development of Government-led MOD personnel certification requirements, crew training plans, crew training catalogs, and other documentation used to manage training.

d. Providing short and long range planning inputs and constraints to optimize crew training and manage crew loading (per week and across the length of their training) to acceptable levels as defined by the Government.

e. Supporting Government-led training integration activities required to develop crew training plans and products to accomplish defined mission objectives. These plans and products shall be integrated and coordinated with NASA's international partners to ensure all partners' training requirements are accomplished.

f. Maintaining support tools for Government-led Crew and Flight Control team training and scheduling or similar function.

g. Planning for On Board Training (OBT) that will be conducted for crewmembers.

h. Planning for flight controller, instructor, and analyst training and certification.

i. Providing qualified personnel at the frequency of need into the flight controller, instructor, and analyst training programs to meet the requirements of the Government.

4.2.2 TRAINING INTEGRATION

The contractor shall provide Training Integration support to the Government which includes but is not limited to:

a. Providing training team leads to manage training teams and conduct training in accordance with NASA processes and products (e.g., Chief Training Officers (CTOs)).

b. Coordinating with the NASA Flight Crew Office to incorporate their input into all crew training requirements, plans, flows, curricula, and facilities.

c. Monitoring, evaluating, documenting, and providing feedback to the Government on student (Crew or MOD personnel) performance during certification and mission training activities. Performance issues revealed during training will be resolved within the relevant operations forums, working groups, and NASA management chains while maintaining privacy with the issue. The Government is the certifying authority for all positions.

d. Suggesting ways to the Government to continuously improve training requirements, curricula, products, and execution.

e. Assisting NASA MOD in assessing the quality of the training being delivered.

f. Supporting post-flight crew debriefs and other post-training debriefs to gather feedback on training effectiveness in order to fold these improvements back into the NASA MOD training processes and curricula for crews and MOD personnel still in training.

g. Providing training inputs (including briefing preparation, execution, and action item response), and technical representation to boards, panels, and working groups (e.g., Training Readiness Reviews, Spaceflight Training Control Board, Core Systems Crew Training Working Group) as directed by the Government.

h. Supporting the planning for all training and all simulations, including but not limited to joint integrated training simulations utilizing NASA, IP, and other Partner simulators, MCCs, Flight Control Teams, Instructor teams, and Flight Crews.

4.2.3 FACILITY INTEGRATION

The contractor shall provide Facility Integration support to the Government which includes but is not limited to:

a. Performing pre-event simulator operations and checkout in preparation for support of Government-led real-time mission tests, mission following, procedure validation and verification, and other mission support testing.

b. Providing short and long range planning inputs and constraints to the Government to optimize utilization of training systems (e.g., part-task and full-task simulators) and to ensure the required training can be accomplished.

c. Supporting the Government-led integration of the functional interfaces between MOD mockups, and spacecraft, hardware, and system simulators to ensure support of the required training.

4.2.4 TRAINING DOCUMENTATION

The contractor shall provide Training Documentation support to the Government which includes but is not limited to:

a. Inputting training records into NASA MOD’s training record system(s).

b. Collecting data documenting the quality of delivered training.

c. Supporting the Government-led MOD CoFR process for training elements.

d. Generating reports as needed on training records data as defined and directed by the Government.

e. Providing training status reports to the Government as requested.

4.2.5 TRAINING SCHEDULES

The contractor shall schedule daily training activities for MOD personnel, ASCANs, crew members, and other personnel according to the constraints, priorities, and direction of the Government.

The contractor shall schedule all activities, instructors, and training facility resources in the NASA MOD training systems for the timeframes allocated for such activities. Training systems shall include but are not limited to:

a. part-task simulators
b. full-task simulators
c. mockups
d. classrooms
e. MCC resources
f. test facilities
g. conference rooms

Training activities shall include but are not limited to:

a. crew training
b. non-crew training
c. instructor practice/certification
d. user tests/evaluations
e. training development

The contractor shall support the Government in coordinating training with activities including but not limited to:

a. Establishing training system allocations with facility schedulers.
b. Coordinating language and logistics services support from established contracts.
c. Coordinating training and non-training events with schedulers at non-MOD organizations (e.g. with Partners, other NASA centers, other JSC organizations).

Short- and long-term training scheduling priorities will be provided by training leads, NASA MOD training integration forums, and NASA MOD management.

The contractor shall maintain support tools for Government-led Crew and Flight Control team training and scheduling.

4.2.6 ADVANCED TRAINING CONCEPTS

The contractor shall support the Government in the development of advanced training concepts and products for space flight systems including but not limited to cooperative work with the IPs, other Partners, Department of Defense (DOD), industry, and other NASA centers.

The contractor shall participate in Government-led trade studies and benchmarking of other organizations to continuously seek improved training methods, utilizing information gained to improve training facilities, processes, and products as directed by the Government.

4.3 TRAINING EXECUTION

At the direction of the Government, the contractor shall execute and/or support training for ASCANs (to include aptitude screening during the selection process), crewmembers, MOD flight controllers, instructors, analysts, and for other personnel (e.g. engineering, International Partners, and Program personnel).

The contractor shall execute proficiency training for all students per the proficiency training requirements set by NASA.

Training preparation shall be provided by the contractor as prescribed by the Government-defined instructional processes and standards, including but not limited to:

a. Determining the skills, scenarios, or procedures to be trained to prepare a crew member for their specific mission.

b. Ordering necessary tools, hardware, and mockups.

c. Specifying and coordinating test facility configuration and support requirements.

The contractor shall perform simulator/simulation operations in support of Government-led real-time mission tests, mission following, procedure validation and verification, and other mission support testing.

The contractor shall provide real-time mission anomaly resolution instructor support for troubleshooting complex hardware and/or software issues in order to develop or modify procedures for the crew to utilize on orbit. This shall include but is not limited to:

a. Calling up and activating training facilities and personnel.

b. Coordinating across organizations and with the associated Programs.

c. Supporting MOD, Engineering, and Program Boards and meetings to accomplish the required objectives.

4.3.1 FLIGHT CONTROLLER, INSTRUCTOR, AND ANALYST TRAINING EXECUTION

The contractor shall provide training to Flight Controller, Instructor, and Analyst personnel, with activities including but not limited to:

a. Providing instructor support for the planning and execution of training and simulations, including joint integrated training simulations utilizing NASA and IP and other Partner simulators, MCCs, Flight Crews, Flight Control Teams, and Instructor teams.

b. Teaching classes, conducting tests, and operating in full task and part task simulator console positions on an individual basis or as part of the training team depending on the type of training session.

c. Monitoring and providing feedback of training system performance, using NASA defined tools and processes.

d. Monitoring, mentoring, evaluating, and providing technical feedback of student performance to the NASA certifying official, using NASA defined evaluation tools and processes.

e. Documenting an assessment of which objectives have been accomplished by the student in the training and whether additional training is required to give credit for the training.

4.3.2 FLIGHT CREW TRAINING EXECUTION

In accordance with the Government-defined generic and mission/increment specific training plans (e.g., crew training catalog), the contractor shall conduct flight crew training with activities including but not limited to:

a. Providing instructors for classes, tests, simulations, and team training of flight crews.

b. Providing instructor support for Crew On-Board Training (OBT) events.

c. Documenting an assessment of which objectives have been accomplished by the crewmember in the training and whether additional training is required to give credit for the training.

d. At Government direction, assisting astronauts at IP, other Partner, and other remote facilities by supporting activities including but not limited to crew training, working group or preparatory meetings, and simulator operations.

e. At Government direction, conducting training for certification for the Capsule Communicator (CAPCOM) position, which is staffed by astronaut or MOD personnel as selected by the Government.

4.3.3 CERTIFICATION REQUIREMENTS

The contractor flight controllers, instructors, and analysts shall receive training and be certified at the end of their discipline-specific training, Command training (where applicable), and certification flows per the Government-defined processes in the MOD Space Flight Personnel Certification Plan (DA-WI-16), including but not limited to conforming to security clearance guidelines, random drug testing, Homeland Security Presidential Directive 12 (HSPD-12) requirements, and passing health physicals. The contractor shall comply with the requirements associated with post-certification policies related to maintaining proficiency, currency, flight controller physicals, decertification, and recertification on a case by case basis as the situation warrants.

5.0 MISSION EXECUTION (FLY)

MOD conducts and is responsible for all real-time NASA human space flight operations and for support to other space flight operations, including but not limited to ISS visiting vehicles and vehicle development test flights. Space flight operations are executed by a Flight Control Team (FCT) that is led by a NASA Flight Director (FD) and consists of flight controllers and support personnel that are functionally organized into various disciplines to optimize effectiveness and efficiency. These disciplines are comprised of both government and contractor personnel, which are required to work together seamlessly to ensure safety and mission success. The FCT members perform the functions described below and provide recommendations to the FD for decision and approval. The FD has the ultimate responsibility for overall mission success and safety of the crew and vehicle.

Mission execution constitutes all phases of flight, including pre-launch, ascent, orbit, descent, landing, post-landing, and subsequent debriefs. All flight controller positions require training and certification per MOD's comprehensive and discipline-specific certification plans.

5.1 FLIGHT CONTROL TEAM STAFFING

The overall Flight Control Team workforce sizing and skill mix will be based upon current NASA Program and commercial services requirements and will vary over the contract period of performance. The disciplines primarily support operations from the MCC-Houston, but may also be required to support from other sites (e.g., office / remote, International or commercial partner locations, the Kennedy Space Center, Marshall Space Flight Center). Real-time on and off console support for flight operations may be continuous, daily, as planned, or on-call dependent upon discipline, workload, criticality and/or complexity of on-orbit operations, and other factors. Response time requirements apply to on-call support from FCT personnel.

The contractor shall provide certified FCT console personnel to conduct mission execution.

5.1.1 SUPPLEMENTAL MISSION EXECUTION SUPPORT

At times situations arise in real-time which require additional personnel to support the on-console FCT.

As directed by the Government, the contractor shall provide additional personnel with the appropriate certification level to support real-time mission execution. These support roles shall include but are not limited to:

a. Meeting Support.

b. Participation in anomaly resolution teams.

c. Setting up, conducting, and debriefing tests, simulations, or verification runs.

d. Replanning efforts.

e. Acting as a substitute for, or addition to, on-console personnel.

f. Serving as a Backup Control Center (BCC; short term evacuation) or Alternate Control Center (ACC; long term evacuation) FCT member

g. Assistance from non-certified or administrative personnel.

5.2 REALTIME FLIGHT CONTROL (INCLUDING NOMINAL AND CONTINGENCY SUPPORT)

The contractor shall perform FCT functions for mission execution, ensuring safety and mission success in real-time operations.

A Flight Controller's duties shall include but are not limited to:

a. Thorough preparation for console support:
    i. Review of the timeline and understanding of the discipline's role in activities.
    ii. Review of applicable procedures, flight rules, handbooks, constraints and other guidelines; ensuring use of the latest, applicable versions.
    iii. Understanding of vehicle or system status, configuration, and recent changes or malfunctions.
b. Monitoring spacecraft or system data and conducting evaluation and trend analysis of changes in performance while continuing to conduct the other required duties of a Flight Controller.
c. Building, verifying, and sending commands to the vehicle or system (command certification required).
d. Operating on-board systems from the ground using approved procedures (e.g. nominal or off-nominal system configuration, or robotic operations).
e. Following the crew's actions and monitoring their progress working through procedures.
f. Maintaining situational awareness of crew, vehicle/system, and FCT status.
g. Maintaining situational awareness of International and other partner status, visiting vehicle status, and the status of other entities involved in mission execution.
h. Performing real-time analysis and providing detailed results/recommendations for planned, unplanned, or contingency operations:
    i. Maintaining awareness of past, current, and future technical situations and recommending prioritization of activities.
    ii. Continually assessing next potential and worst-case failure scenarios.
    iii. Responding to failures using applicable procedures and flight rules appropriate for the conditions.
    iv. Providing expert advice to the FCT, FD, and crew on a recommended course of action and implications specific to the discipline.
    v. Providing failure workaround, system reconfiguration, and/or in-flight maintenance options and recommendations, presenting the information in a concise failure-impact-workaround format.
    vi. Performing analysis such as robotics, consumables/resource availability and planning, trajectory and attitude, altitude strategy, debris tracking and avoidance, science support, structural/loads, thermal, and other analyses.
i. Communication
    i. Using clear and concise written and verbal communication to convey information in a timely manner.
    ii. Monitoring appropriate FCT voice channel loops including the FD loop, while monitoring crew communication channels for possible implications to the discipline.
    iii. Writing information in a Flight Note whenever time is available.
    iv. Writing messages/procedures for uplink using standard formats and nomenclature.

v. Producing required console documentation such as console logs, handover logs, anomaly reports, Mission Action Requests (CHITs), consumables usage, limited life reports, hardware/system configuration or stowage changes.

vi. Coordinating /confirming information and plans within the specific discipline, with other disciplines, the Flight Director, and with outside entities such as Engineering, the Program, Safety, and NASA's partners.

vii. Attending meetings (e.g. Mission Management Team (MMT), anomaly resolution team, replanning) to represent a specific discipline.

j. Providing replanning inputs on time and in the proper formats.

k. Providing and coordinating stowage inputs on time and in the proper formats.

l. Performing long range planning and integration of mission timelines with FCT disciplines, other NASA organizations, IPs, partners, and other entities as needed.

m. Supporting Public Affairs briefings as requested by the Flight Director.

5.3 POST FLIGHT ACTIVITIES

Following a flight, significant activity, or phase (e.g. an ISS Increment), the contractor shall support activities including, but not limited to:

a. Preparing debrief reports and documenting Lessons Learned.

b. Attending debrief meetings and documenting proceedings.

c. Assigning/completing actions as needed to correct operational processes and products.

d. Archiving mission execution data, logs, video, and other information.

5.4 FLIGHT CONTROLLER GUIDELINES

The contractor shall understand and conduct operations in accordance with Flight Controller operational documentation including but not limited to:

a. Flight procedures (crew and ground)

b. Flight Rules

c. FCOH (Flight Controller's Operational Handbook)

d. OIP (Operations Interface Procedures)

e. OCADs (Operational Control Agreement Database) and Hazard Reports

f. Program requirements and priorities documentation

g. Console Handbooks

h. Systems and hardware operational constraints

i. Discipline specific work instructions

6.0 FLIGHT CREW OPERATIONS DIRECTORATE SUPPORT

The FCOD is responsible to the NASA Space Flight or Mission Programs for tasks including:

a. Providing flight crews to execute the missions planned in the space flight/mission manifests.

b. Providing flight crew input to the development and assessment of new or changing requirements in the Space Flight Programs, including participating in development, execution, and evaluation of training facilities, flight hardware and software, and flight crew equipment.

c. Providing flight crew input to the resolution of operations related issues in the Programs.

The Government will lead and is responsible for new capability development and certain non-mission-specific Programmatic support.

6.1 PROGRAM REQUIREMENTS DEVELOPMENT / CHANGE TECHNICAL ASSESSMENTS

The contractor shall support the Government with requirements analysis and technical assessments, including but not limited to:

a. Providing reports, assessments, and technical evaluations of Program development requirements and requirement changes that have potential impact to crew procedures, safety, or operations.

b. Processing change requests (CRs), or equivalent, review process for the flight crew, including routing of CRs for flight crew evaluations and maintaining an existing database of all such reviewed CRs for boards (or their successors).

c. Maintaining awareness of flight crew official positions on systems level hardware, software, and operational procedure changes affecting the crew.

d. Evaluating flight software discrepancy reports, or equivalent, and user/operational notes, or equivalent, for crew operational and safety impacts.

e. During the conceptual design of each new software release/update, evaluating the crew operational and safety impacts of concept proposals for software changes.

f. Providing technical evaluations of the crew operational and safety impacts of specific, identified changes to the spacecraft hardware, software, and operations.

g. Providing technical evaluations of the crew operational and safety impacts of specific, identified changes to the utilization science and payload hardware, software, and operations.

h. Initiating and presenting changes for a wide range of hardware, software, and operations that affect the crew.

i. Developing and presenting briefings to assigned flight crew.

6.2 FLIGHT CREW EQUIPMENT (FCE) INTEGRATION

The contractor shall manage the requirements of the Government for FCE and establish and maintain coordination between the flight crew and hardware suppliers for FCE.

The contractor shall initiate Government requested changes and present FCE CRs, or equivalent, representing the assigned flight crew FCE requirements to the boards, and shall provide status to the crew members and/or Astronaut Office on CRs affecting FCE.

The contractor shall participate in the Government-led development of requirements for provisioning, stowage, and manifesting of hardware and crew items and equipment.

The contractor shall be responsible for tracking Astronaut Office-accountable crew preference equipment.

6.3 FLIGHT CREW TRAINING

In support of NASA-developed flight crew training, the contractor shall provide support to the Government, including but not limited to:

a. Coordinating and providing flight crew input into specific, identified crew training plans, flows, curricula, and facilities.

b. Identifying and documenting crew issues and crew positions.

c. Disseminating flight crew positions to the relevant organization.

d. Providing reports and assessments of operational impacts of training issues.

6.4 OPERATIONS AND OPERATIONS DEVELOPMENT FOR SPACEFLIGHT / MISSION

The Contractor shall provide support to the Government for the accomplishment of the operations and operations development of space flight/mission tasks for which NASA FCOD is responsible.

The contractor shall provide support to NASA FCOD and the flight crew with assessments, technical evaluations, and reports related to spacecraft elements, including but not limited to:

a. Spacecraft operations and utilization concepts, plans, tasks, and procedures.

b. Integrated operations scenarios.

c. Flight rules.

d. System and payload / utilization designs including functional descriptions, drawings, and schematics.

e. Change notices that affect crew-related requirements or implementation.

f. FCE support systems including habitability support.

g. Crew displays and controls.

h. Visiting Vehicle integration.

The contractor shall develop and review test plans for the spacecraft systems, payloads / utilization, tools, and procedures that require ground-based testing.

The contractor shall coordinate crew participation in such tests and document the results.

6.5 SPACE FLIGHT PROGRAM INTEGRATION

The contractor shall provide program-level board support to the Government, including but not limited to:

a. Providing technical inputs to the FCOD representatives to the programmatic boards, associated sub-boards, and panels.

b. Presenting the FCOD position.

c. Developing and delivering presentations.

d. Identifying impacts due to proposed requirements changes.

e. Exchanging technical vehicle and operations information.

f. Interfacing with Programs and Program elements to resolve flight preparation process implementation issues.

g. Participating in trade studies, assessment activities, and action item resolution as necessary, to support mission preparation.

6.6 FLIGHT CREW / VEHICLE INTEGRATION AND TESTING

At the direction of the Government, the contractor shall provide the operations interface between flight operations involving the flight crew and processing or launch operations at KSC and MSFC and any partner or NASA-designated sites.

The contractor shall implement the Vehicle Integration Plan for Space Operations (JSC 17519).

At the direction of the Government, the contractor shall provide on-site support at facilities of any partners in support of prelaunch testing, integration, and other activities preparatory to the launch of spacecraft/visiting vehicles.

6.7 CAPSULE COMMUNICATOR (CAPCOM) SUPPORT

At the direction of the Government, the contractor shall provide CAPCOM console support in the Mission Control Center (MCC) and is eligible for any CAPCOM related assignments including but not limited to:

a. Supporting console in the MCC during mission operations and simulations.

b. Acting as a crew advocate in the MCC and operations forums.

c. Performing and managing voice communications with the crew on orbit.

d. Coordinating use of the air- or space-to-ground communication loop(s) by other users (e.g., MCC-Moscow Glavni Operator or members of other control centers).

7.0 PROGRAM AVIONICS AND SOFTWARE OFFICE INTEGRATION, COORDINATION, AND SUPPORT ACTIVITIES

The contractor supports NASA in the performance of avionics and software integration activities with International Partner, other partner, and/or US element providers including but not limited to Visiting Vehicle, Payloads and Government Furnished Equipment (GFE) organizations in support of the Program Avionics and Software Office for the tasks outlined in this section. This support from the contractor includes participation in various meetings, boards, panels, and working groups.

7.1 INTERNATIONAL AND/OR US PARTNER INTEGRATION FOR AVIONICS AND SOFTWARE

The contractor shall support the Government in integration activities including but not limited to:

a. Documenting data and software requirements from International Partners and/or any US element providers and participate in NASA supported element/segment-level reviews.

b. Providing technical integration and programmatic coordination between program office and International Partners and/or US element provider organizations to ensure compliance with applicable avionics and software interface requirements.

c. Analyzing, evaluating, and supporting disposition of software change requests (SCRs) in accordance with established Avionics and Software Office processes and procedures.

d. Integrating inputs from Operations, Engineering, Software Development, and Safety organizations on proposed software changes to develop recommendation(s) for the Board(s) and Panel(s) as required.

e. Coordinating and integrating documentation in support of various program level reviews including endorsements for various readiness reviews.

f. Initiating and integrating scheduling requests in support of joint activities such as testing, hardware and software deliveries.

g. Assisting International Partners and/or US element providers in their software deliveries for joint testing and flight following activities.

h. Providing engineering assessments, requirements analysis, and test plan reviews for integrated system analyses, testing, and formal verification.

i. Providing technical integration for various flight software release packages including integration with the Mission Operations and Engineering organizations, and providing support to on-orbit operations as required.

7.2 SOFTWARE AND AVIONICS COMMAND AND TELEMETRY INTEGRATION

The contractor shall provide Command and Telemetry support to the Government and the Avionics & Software teams including but not limited to:

a. Documenting on-board & ground data requirements from various IP's or US element providers in support of program objectives. Coordinating command, telemetry and data requirements with MOD and IP/MCC-H ground segment data teams.

b. Coordinating data and tool requirements for integration into the mission avionics and reconfiguration system, program command and telemetry, Standard Out and MCC-H

processes. Coordinating command and telemetry processing guidelines into command and telemetry production cycle.

7.3 AVIONICS AND SOFTWARE ADMINISTRATIVE SUPPORT

The contractor shall provide the Government with administrative support to the Program Avionics & Software Integration teams as follows:

a. Preparing and coordinating Government-led teleconferences and Technical Interchange Meetings (TIMs) with International Partners (IPs), US partners, and various Program participants. Developing minutes, actions, and follow-up to teleconferences & TIMs. Maintaining and uploading agendas and minutes to the NASA Avionics and Software Office website.

b. Maintaining and supporting documentation development for various Avionics and Software projects including related export control activities. Coordinating issues and action items with various organizations.

c. Maintaining integration schedules and all program documentation as related to various projects on the program office website.

d. Coordinating required documentation for travel and security badging for Avionics and Software Office official visitors.

7.4 COMPUTER RESOURCES

The contractor provides support to NASA's Computer Resources teams as follows:

7.4.1 SPACE STATION COMPUTER (SSC) SUPPORT

The contractor shall provide Space Station Computer (SSC) support to the Government including but not limited to performing all activities related to the development, integration, test and delivery of the Station Support Computer (SSC) File Server and SSC Client integrated product suite (which serves as part of the overall integrated ISS on-orbit Information Systems Network utilized to support ISS Crew on-orbit operations).

The contractor shall perform the activities associated with the development of an Integrated SSC load including but not limited to the following:

a. Performing Flight Media Fabrication (CD/DVD) and Flight Laptop Hardware Loading as required to support the delivery of the Integrated SSC integrated products and applications.

b. Performing SSC Lab scheduling and Operations Coordination including the office/lab hardware and inventory tracking.

c. Performing all necessary tasks to support the integration of the SSC File Server and SSC Client architecture into the Joint Station LAN (JSL) network architecture to support the on-orbit utilization.

7.4.2 SPACE OPERATIONS COMPUTING

The contractor shall provide Space Operations Computing support to the Government including but not limited to:

a. Performing all activities related to the development, integration, test, and delivery of the Space Operations Computing applications and products. Delivering specialized or unique integrated loads to meet specific Mission and Crew Objectives.

b. Performing Flight Media Fabrication – Compact Disc (CD) and (DVD) and flight laptop hardware loads as required to support the delivery of the integrated products and applications.

c. Developing custom software applications, modified Commercial-of-the-Shelf (COTS) software and/or the integration of COTS software into Government Furnished Equipment (GFE) hardware to support on-orbit Crew's mission objectives.

7.4.3 COMPUTER RESOURCES INTEGRATION

The contractor shall provide Computer Resources Integration support to the Government including but not limited to:

a. Performing all activities related to analysis, documentation, and processing of manifesting requirements for Space Station Computer Resources hardware and peripherals for all US and international cargo and manned visiting vehicles.

b. Performing all activities and duties related to the coordination, processing, and delivery of the CD case for manifest and delivery on-orbit including the management of the on-orbit CD Library and its corresponding CD management databases.

c. Coordinating technical requirements with end-users for the provision and delivery of computer resources hardware and peripherals.

d. Coordinating and managing the Computer Resources Hardware Depot and supporting the maintenance and sustaining of all Computer Resources hardware for both ground and flight utilization.

e. Providing technical integration and support for processing and closure of Failure Investigation Anomaly Reports (FIARS), Discrepancy Reports (DRs) and Items for Investigations (IFIs) including coordination with the Mission Evaluation Room (MER) and troubleshooting and problem resolution of computer resources hardware.

f. Supporting the analysis of technical requirements for next generation Computer Resources hardware and peripherals for future deployment and on-orbit utilization.

g. Participating in various operations working groups as required to support the processing and sustaining of Computer Resources hardware and peripherals.

7.4.4 REAL TIME MISSION SUPPORT

The contractor shall provide Real-time ISS Mission support as well as on-call support as requested by the Government including but not limited to:

a. Providing operational technical support related to the on-orbit deployed SSC file server(s) and the client architecture.

b. Supporting all delivered SSC product applications and loads.

(End of clause)

(END OF SECTION)